viously reported[2]). Strictly one should use scattering correction factors based on the precise geometry employed by Domanic and Sailor. This may partly explain the 13% difference between the mean value of 0.23 in Table I and the 0.26 value of Beckurts *et al.*[1]. This suggests that the value reported by Beckurts is more correct.

Some years ago(in 1956 while preparing References 4 and 5) we had performed preliminary measurements on the ratio of the 14-sec to 54-min activities of In^{116} by exposing a 3.5 mg/cm^2 foil in an Atomics International Solution Reactor operating at approximately 2 watts. The ratio obtained of the 14-sec and 54-min activities was 0.26.

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Cross Section and Half Life for the $Fe^{54}(n,p)$ Mn^{54} Reaction

Clare, Martin and Kelly[1] have determined the average 'fission' cross section of the $Fe^{54}(n,p)$ Mn^{54} reaction to be 73 mb relative to 107 mb for the Ni^{58} (n,p) Co^{58} reaction. This determination involved the use of a half life of 291 d[2] for Mn^{54}. There is at present, however, some discrepancy in reported values of this half life[2,3,4], ranging between 291 and 314 d. In their experiment performed in the Harwell materials testing reactor PLUTO, Clare et al[1], irradiated enriched iron (95% Fe^{54}) foils enclosed in gadolinium to reduce thermal-neutron activation of the small fraction of Fe^{58} in the foils. This competing activation was subsequently shown to be negligible for these foils. The decay of the activities of three of these foils has been followed for one half life of Mn^{54}, and this half life has been determined. The method of measurement using a T.P.A. ionization chamber has been described by Clare *et al*[1]. The first activity measurement, S_1, in the decay was made at a time t_1, 102 d. after the end of the irradiation, and the results are plotted in Figure 1 as the logarithm of the ratio of S_1 to the activity at time t_2 as a function of the time interval between measurements, $(t_2 - t_1)$. The best straight line through the results has been calculated by the least-squares method and the half life of Mn^{54} given by this line is (303 ± 1) d.

The long-term drift of the ionization chamber readings appears from the Co^{60} standard measurements to be random within ± 3%, and short-term variations show that the ratio of measured Mn^{54} to Co^{60} activities varies much less than this. Therefore, the ionization-chamber factor of 2.84 reported by Clare *et al.*[1], which allows for the different decay schemes of Mn^{54} and Co^{60}, is expected to be essentially constant throughout the time of the investigation, about 300 d.

Substituting the value of 303 d for the Mn^{54} half life, determined in this investigation, into the results of Clare *et al.*, the mean 'fission' cross section for the Fe^{54} (n,p) reaction is (76 ± 3)mb. This now gives the ratio of $\sigma(Ni^{58})/\sigma(Fe^{54})$ as 1.41, in better agreement with the value of 1.38 determined by Hogg and Weber[3] than the previous value of 1.46 reported by Clare *et al.*, using 73 mb for the Fe^{54} (n,p) reaction.

An enriched iron foil has been irradiated together with nickel and cobalt monitors for 3 months in a hollow fuel element in the Harwell materials testing reactor DIDO. The cross section obtained from this irradiation, using 303 d for the Mn^{54} half life, is 74 mb relative to 107 mb for the $Ni^{58}(n,p)$ reaction. This is in good agreement with the value of (76 ± 3) mb. more accurately determined from the 3-day irradiation in PLUTO.

Clare *et al.*[1], give the correction for thermal-neutron activation of Fe^{58} present in iron foils by the following equation.

$$\frac{S_{app}}{S_{true}} = 1 + C\cdot\frac{\phi_{th}}{\phi_f}\,\frac{[1-\exp.(-\lambda_{58}t_i)]}{[1-\exp.(-\lambda_{54}t_i)]}\,\frac{\exp.(-\lambda_{58}t_0)}{\exp.(-\lambda_{54}t_0)}\ ,$$

where $C = \dfrac{a_{58}\sigma_{58}}{a_{54}\sigma_{54}}\cdot\dfrac{A_{54}f_{54}}{A_{58}f_{58}}$,

σ_{58} = thermal neutron activation cross section of Fe^{58}

σ_{54} = fast neutron activation cross section of Fe^{54}

a_{58} = abundance of Fe^{58} in the foil

a_{54} = abundance of Fe^{54} in the foil

A_{58} = atomic weight of Fe^{58}

A_{54} = atomic weight of Fe^{54}

λ_{58} = decay constant of Fe^{59}

[1]D. M. CLARE, W. H. MARTIN and B. T. KELLY, "Intercomparison of fast neutron flux monitors in a hollow fuel element in PLUTO." *Nucl. Sci. Eng.* **18**, 4, 448-458, (1964).

[2]R. A. ALLEN, D. B. SMITH and J. E. HISCOTT, "Radioisotope Data." A.E.R.E.—R-2938. (1961).

[3]C. H. HOGG and L. D. WEBER, "Radiation Effects on Metals and Neutron Dosimetry," A.S.T.M. (1963).

[4]R. L. RITZMAN *et al.*, "Radiation Effects on Metals and Neutron Dosimetry," A.S.T.M. (1963).

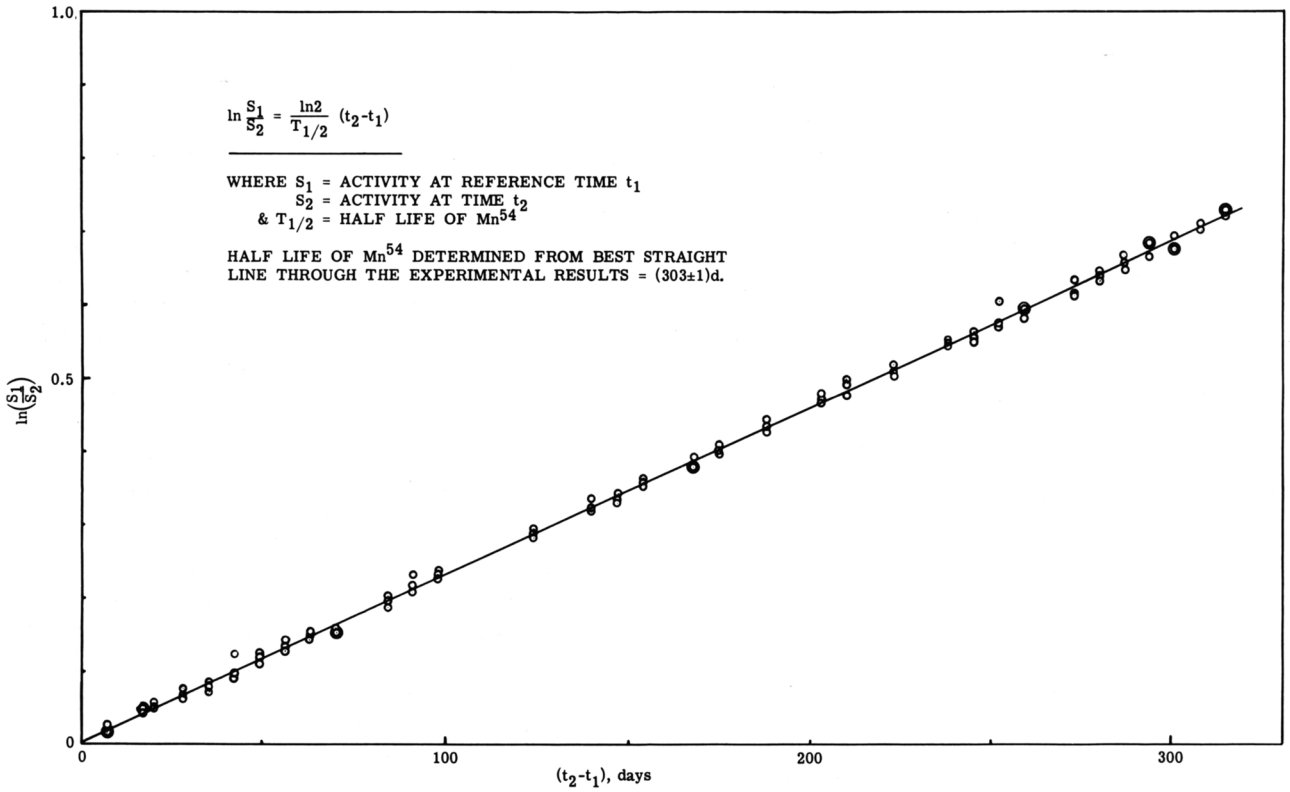

Fig. 1. Radioactive decay of Mn^{54} present in irradiated foils of iron enriched in Fe^{54}.

λ_{54} = decay constant of Mn^{54}

f_{58} = T.P.A. ion chamber factor for Fe^{59}

f_{54} = T.P.A. ion chamber factor for Mn^{54}

ϕ_{th} = thermal neutron flux

ϕ_f = fast neutron flux

t_i = irradiation time

and t_0 = time between end of irradiation and measurement.

This equation is only approximate in that it neglects the activity of Co^{60} produced subsequent to the decay of Fe^{59}, but this is unimportant when the ratio of thermal- to fast-neutron flux is less than about 5. Enriched iron foils have been irradiated together with nickel and cobalt monitors for 41 d in a monitoring stringer in the graphite moderator of the Advanced Gas-Cooled Reactor at Windscale, where the ratio of thermal- to fast-neutron flux is about 20. In this experiment C can be determined more accurately than for irradiations in hollow fuel element facilities in materials testing reactors where the ratio of thermal- to fast-neutron flux is at least 10 times lower. The value of C obtained from the AGR irradiation, allowing for the additional activity of Co^{60}, which is ~20% of the activity of Fe^{59} in this case, is $(4.0 \pm 0.8) \times 10^{-3}$. The values of a_{58} and f_{58} are not known with sufficient accuracy to enable this measured value of C to be applied to irradiations of foils with different a_{58}/a_{54} ratios.

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On the Transport Equation in Plane Geometry*

We propose to show that the stationary, monoenergetic transport equation, under the restrictions of plane symmetry and isotropic scattering, is equivalent to a singular integral equation with the space variable appearing as a parameter. This transformation was suggested by the work of Leonard and Mullikin[2], where complex transforms of

*This work is part of the doctoral thesis[1] submitted to the Nuclear Engineering Department of the University of Michigan and performed under the auspices of the U.S. Atomic Energy Commission.